

# Feral Mallards: a risk for hybridisation with wild Pacific Black Ducks in Australia?

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## Abstract

Hybridisation is widespread in waterfowl and hybrids are often fertile. Mallards *Anas platyrhynchos* hybridise with numerous dabbling ducks and have been associated with decline in many *Anas* species with which they co-occur. Mallards have been introduced in Australia and New Zealand where they hybridise with indigenous Pacific Black Ducks *Anas superciliosa*. The extent of hybridisation in Australia is unknown, but Mallards pose a potentially serious threat to endemic duck populations and have already caused the extinction of some populations of Pacific Black Ducks in New Zealand, Lord Howe Island and Macquarie Island. The distribution and abundance of Mallards and the extent of hybridisation in Australia must be determined as a priority to ensure the long-term genetic integrity of the Pacific Black Duck. (*The Victorian Naturalist* 126 (3) 2009, 87-91).

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## Introduction

The Pacific Black Duck *Anas superciliosa* is a dabbling duck native to the West Pacific, and is sometimes divided into three subspecies: the Australian Black Duck *A. s. rogersi* from Australia, New Guinea and Indonesia, the New Zealand Grey Duck *A. s. superciliosa* from New Zealand and outlying islands, and the Lesser Grey Duck *A. s. pelewensis* from Pelew and other islands in the West Pacific (Amadon 1943; Rhymer *et al.* 2004). The Lesser Grey Duck is much smaller and easily distinguished from the two other subspecies (Frith 1967; Schodde 1977). The New Zealand Grey Duck and the Australian Black Duck are of similar size and may differ only marginally in plumage (Frith 1967). Both the New Zealand Grey Duck and the Lesser Grey Duck are declining (Threatened Waterfowl Specialist Group 2003). In both cases, hybridisation with either wild or domestic Mallard *A. platyrhynchos* is likely to play a role in reducing their genetic integrity and may contribute to significant population declines.

## Hybridisation in waterfowl

Hybridisation in waterfowl is quite common, with more than 500 hybrid combinations reported for Anseriformes in the wild or in captivity (McCarthy 2006). Interestingly, many of those hybrids are fertile, while in other orders

chromosomal imbalances cause hybrid sterility (McCarthy 2006). Mallards are known to hybridise with 40 species in the wild and a further 20 species in captivity (McCarthy 2006). Seventeen of these naturally occurring crosses produce hybrids that are at least partially fertile (McCarthy 2006). In extreme cases, hybridisation can lead to introgression, the mixing of the gene pool of the two species that hybridise to such a degree that the individual gene pool of the two parents does not exist anymore, which can lead to extinction if left unchecked (Rhymer 2006). This has occurred on the West Pacific Islands of Guam, Tinian and Saipan where Mallards and Pacific Black Duck hybridised to such an extent that both species became locally extinct and only hybrids were left (Yamashina 1948).

Hybridisation and introgression with Mallards is thought to be one of the important threats causing the decrease in some endangered species, the Hawaiian Duck *A. wyvilliana* (Engilis *et al.* 2002), the Meller's Duck *A. melleri* (Jones 1996) and the New Zealand Grey Duck *A. s. superciliosa* (Gillespie 1985), and has been found to threaten three other species, the Mexican Duck *A. diazi* (Short 1978), the American Black Duck *Anas rubripes* (Ankney *et al.* 1987) and the Yellow-billed Duck *A. undulata* (Milstein and Osterhoff 1975). Mallards are

physically dominant over, and have been implicated as a threat to, Pacific Black Ducks wherever they co-occur, due to their increased capacity for survival, greater fecundity and productivity, and willingness to exploit human environments (Williams and Basse 2006). Thus, Mallards hybridise with and threaten Pacific Black Ducks in New Zealand (Gillespie 1985), Lord Howe Island (Tracey *et al.* 2008), Macquarie Island (Norman 1987) and the Australian mainland (Braithwaite and Miller 1975).

### New Zealand

Pacific Black Ducks are thought to have colonised New Zealand from Australia somewhere between 5000 and 20000 years ago (Hitchmough *et al.* 1990). Mallards were first introduced on the South Island from European game-farm stocks by the Otago Acclimatization Society in the mid-1800s, and later on, birds from North America were introduced on the North Island by the Auckland Acclimatization Society in the 1930s (Williams 1981). By 1963 over 20000 Mallards had been released throughout New Zealand (McDowall 1994). In the early 1980s the Mallard population had reached 5 million and was still increasing, while the Pacific Black Duck population had decreased to 1.5 million and was still declining (Marchant and Higgins 1990). The first hybrid was reported in 1917 and since then hybrid frequency has increased steadily (Thomson 1922; Gillespie 1985). By the early 1980s, hybrid frequency was estimated at 51% and pure Pacific Black Duck frequency at 4.5% (Gillespie 1985). This is below 5%, the minimum level that is suggested to ensure species survival (Short 1969). The current extent of hybridisation is unknown, but after 24 years since the study by Gillespie (1985), most populations of Pacific Black Duck in New Zealand are now likely to have had some level of exposure to Mallards. Hybrid phenotypes are not continuous in New Zealand, but two types of hybrid exist, Pacific Black Duck-like and Mallard-like hybrids (Gillespie 1985). This is similar to the situation that was observed in the Mariana Mallard *Anas oustaleti* that is thought to have originated from hybrids between Mallards and Pacific Black Duck in the Western Pacific Islands of Guam, Tinian and Saipan (Yamashina 1948; Reichel and Lemke 1994).

### Lord Howe Island

Lord Howe Island (159°05' E, 31°33' S) is situated at the intersection of the range of the three Pacific Black Duck subspecies in the Pacific Ocean east of Australia. Pacific Black Ducks were first recorded on Lord Howe Island in 1852 and breeding has been observed, albeit infrequently, ever since (MacDonald 1853; Hindwood and Cunningham 1950; Rogers 1972). Mallards were first observed in 1963 and probably self-introduced from New Zealand (McKean and Hindwood 1965; Tracey *et al.* 2008). Hybridisation with the local Pacific Black Duck population followed soon after (Rogers 1976). Recent surveys suggest that hybridisation has progressed and that pure Pacific Black Ducks are now absent (Tracey *et al.* 2008). Furthermore, Pacific Black Duck-like hybrids represent only 2% (*s.e.* = 0.59, *n* = 86) of the population (Tracey *et al.* 2008). Pacific Black Ducks are thus effectively extinct on the island and only extermination of Mallards and their hybrids would allow Pacific Black Ducks to re-establish themselves (Tracey *et al.* 2008).

### Macquarie Island

Macquarie Island (158°53' E, 54°35' S) is situated south-east of Tasmania and south-west of New Zealand (Copson 1984; Norman 1987). The island had a small resident breeding population of Pacific Black Ducks from at least the late 1800s (Hamilton 1895, Norman 1987). Mallards were first recorded on the island in 1949 (Gwynn 1953). During the following 25 years, a few scattered records of Mallards exist, but they do not seem to have established themselves until 1975 (Norman 1987). The provenance of the Mallards has not been established, but they probably self-introduced from New Zealand or maybe from Campbell or Auckland Islands (Norman 1987, 1990, OSNZ 1990). A Mallard x Pacific Black Duck hybrid was observed in 1973, but it is unclear if it had been bred locally (Norman 1987). Hybrids became common in 1978 and by 1985 most ducks observed on the island were hybrids (Norman 1987, 1990).

### Australian Mainland

Mallards were introduced to Australia for recreational hunting from the 1860s, but unlike in New Zealand, they did not colonise the whole country and were restricted to areas around urban centres (Marchant and Higgins 1990).

Most of the Mallards in Australia today are of domestic origin. Because of their domestic origin, Mallards are 50% heavier than Pacific Black Ducks and have highly variable plumage (Marchant and Higgins 1990). The feral Mallards are thought to rely on urban habitat as they were previously not recorded in hunter bag surveys (Braithwaite and Norman 1974). However, recent anecdotal information from hunters suggests hybrids are occurring more frequently in rural areas (B. Boyle, Game Council NSW, pers. comm.; P.-J. Guay unpublished data). Pacific Black Ducks have a much wider distribution, being present throughout Australia except for the central desert (Marchant and Higgins 1990). Mallards and Pacific Black Ducks hybridise extensively and their progeny have been reported from various parts of the country (Braithwaite and Miller 1975; Whatmough 1978; Smith and Smith 1990; Paton *et al.* 1992; Bielewicz and Bielewicz 1996). Neither Mallards nor hybrids are reported in hunter bag surveys (Braithwaite and Norman 1974, 1976), but both occur in urban wetlands. This led Braithwaite and Miller (1975) to conclude that hybridisation is limited to cities and is not a threat to Pacific Black Ducks in Australia. Since then, concerns about the future of Pacific Black Ducks in the presence of Mallards have been expressed by a number of authors (Parker *et al.* 1985; Paton *et al.* 1992; Rhymer *et al.* 2004; Williams and Basse 2006). The lack of hybrids in hunter bags may suggest that, like Mallards, F1 hybrids are mostly sedentary in urban wetlands and that offspring of back crosses with Pacific Black Ducks disperse out of cities. Phenotypical studies have demonstrated that hybridisation is spreading in South Australia (Paton *et al.* 1992) and that hybrids are now shot by hunters in rural parts of Tasmania, New South Wales and Victoria (B. Boyle, Game Council NSW, personal communication, P.-J. Guay unpublished data). Investigations limited to phenotypes may also be underestimating the extent of the problem in Australia, as first generation hybrids may look like Pacific Black Ducks as the white plumage of some breeds of domestic Mallards is likely to be recessive to the wild-type Pacific Black Duck plumage.

#### **Dynamics of Mallard x Pacific Black Duck hybridisation**

Mallards and Pacific Black Ducks have similar courtship behaviour (Lorenz 1951; Williams

1969), but pair assortively in New Zealand (Gillespie 1985; Hitchmough *et al.* 1990). Similarly, domestic Mallards, Pacific Black Ducks and their hybrids pair assortively on urban wetlands in Australia (Braithwaite and Miller 1975). Courtship behaviour can be quite degenerate in domestic breeds compared to wild Mallard (Desforges and Wood-Gush 1976; but see Miller 1977), which could account for lack of pair formation between domestic Mallards and Pacific Black Ducks (Braithwaite and Miller 1975). Mallards are very aggressive and will dominate most species and can hybridise through forced copulation even if no interspecific pairing occurs (Ankney *et al.* 1987; Brodsky *et al.* 1988; Hitchmough *et al.* 1990). Forced copulations are an important aspect of Mallards mating strategy and can lead to egg fertilisation (Burns *et al.* 1980; McKinney and Evarts 1997). Furthermore, domestication in Mallards has increased reliance on forced copulation to secure mating opportunities (Desforges and Wood-Gush 1976; but see Miller 1977). Simple monitoring of pairing on wetlands where both Mallards and Pacific Black Ducks co-occur may not tell the whole story.

#### **Dispersal of hybrids**

Pacific Black Ducks are highly dispersive (Marchant and Higgins 1990). Band recoveries have demonstrated that they can disperse over the Nullarbor Plain, Bass Strait and the Tasman Sea (Braithwaite and Miller 1975; Marchant and Higgins 1990; Halse *et al.* 2005). In contrast, Mallards seem to be mostly sedentary in Australia and New Zealand (Marchant and Higgins 1990). At fledging, F1 hybrids or F2 back crosses may disperse outside of urban wetlands with other Pacific Black Ducks, spreading the Mallard genes into wild populations.

#### **Monitoring options**

Both the phenotype and the genotype of hybrids have been studied (e.g. Rhymer *et al.* 1994). Various quantitative and qualitative hybrid phenotype classification schemes relying on plumage and bare parts have been established (Braithwaite and Miller 1975; Gillespie 1985; Paton *et al.* 1992; Rhymer *et al.* 1994). These have been used to evaluate the extent of hybridisation in various populations (e.g. Tracey *et al.* 2008). The use of phenotype may be limited because, in hybrid swarms, phenotypes tend to be bimodally distributed and to



converge toward both parental types (e.g. Yamashina 1948), thereby complicating analyses based solely on phenotypes. Furthermore, it is difficult to differentiate hybrids from parental species phenotypically after a few generations of backcrossing (Rhymer *et al.* 1994, Green *et al.* 2000). Alternatively, hybridisation can be monitored genetically: Mallards and Pacific Black Ducks have distinct mitochondrial control region sequences (Rhymer *et al.* 1994). Mitochondrial haplotypes only allow the determination of maternal lines because mitochondrial genes are exclusively maternally inherited (Watanabe *et al.* 1985). This may not be a problem for hybridisation between Mallards and Pacific Black Ducks because both sexes mate inter-specifically in both species. Nuclear genes in contrast would allow better quantitation of hybridisation since they are inherited from both parents (e.g. Fowler *et al.* In Press). Unfortunately, no such markers are currently available for Pacific Black Ducks and Mallards.

### Conservation implications

The extent of hybridisation between Mallards and Pacific Black Ducks in Australia is still poorly understood. While this is often ignored or dismissed, a major potential threat exists. Mallards and their hybrids are known to cause the extinction of Pacific Black Duck populations, as demonstrated in New Zealand, Lord Howe Island and Macquarie Island, and they are increasingly being recorded in rural Australia. To assess the associated risks to Pacific Black Duck, the distribution and abundance of Mallards and the extent of hybridisation must be determined as a priority. New nuclear markers must be developed to allow genotyping of ducks and determination of extent of hybridisation in wild populations. Appropriate management techniques can then be employed to control Mallards and their hybrids both in urban and rural settings. Continued control efforts may also be necessary as wild Mallards are known to travel from New Zealand to Australia (Paton 1991) and further self-introduction of wild Mallards from New Zealand to Australia is an additional on-going threat to the genetic integrity of the Pacific Black Duck.

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Mallard × Pacific Black Duck hybrids on Lord Howe Island where Pacific Black Ducks are now considered extinct. Photo by JP Tracey.